time, the different coloured oxides from the different metals should be selected, which would all bear the same degree of heat.—Say 1300 degrees of Fahrenheit's thermometer, consequently no two oxides of different colours from the same metal would answer, therefore a knowledge of these principles and their application, would enable the manufacturer to adorn and beautify his wares, and to bring to greater perfection the different branches of the arts.

No. XLI.

Observations of the eclipse of the sun, June 16th, 1806; made at Lancaster, by Andrew Ellicott Esquire,

Read August 15th, 1806.

Lancaster, August 1st, 1806

DEAR SIR,

THE following observations, which I request the favour of you to hand to the Philosophical Society, were made at this place on the solar eclipse of the 16th of June last.

The morning was cloudy till about 9 o'clock, when the sun became visible through thin flying clouds: a short time before the beginning of the eclipse, the clouds were so far dissipated, that the limb of the sun was very distinct, and well defined. At $9^h\ 33'\ 8''$ A. M. apparent time, the eclipse began; the first impression made by the moon was at the point expected, and to which my eye was constantly directed.—The end of the eclipse was at $0^h\ 18'\ 56''$ P. M. apparent time.—A few minutes after the eclipse began, the clouds increased so much as to prevent any measures between the points of the cusps or horns being taken till $10^h\ 44'\ 25''$, when the following series commenced.

I.

	Apparent time. h ′ ″	Distance between the points of the cusps by the Micrometer.	Value of the Micrometer in sexagesimals. ′ ″
	10 44 25	58 8	31 32 2
	10 45 20	58 8	31 32 2
	10 46 3	58 5	31 30 2
1	10 46 52	57 48	31 25 7
2	10 47 37	57 34	31 16 6
3	10 48 11	57 5	30 57 7
4	10 48 36	56 43	30 49 9
5	10 49 16	56 23	30 36 9
6	10 49 53	56 8	30 27 1
7	10 50 24	55 49	30 21 3
8	10 50 49	55 37	30 13 5
9	10 51 18	55 23	30 4 4
10	10 51 46	55 12	29 57 2
11	10 52 20	55 4	29 52 0
12	10 53 0	54 48	29 48 1
	10 55 27	53 48	29 15 6
12	10 57 16	55 23	30 4 4
11	10 57 52	55 38	30 14 4
10	10 58 31	56 2	30 23 3
9	11 0 2	56 33	30 43 4
8	11 0 30	56 45	30 50 2
7	11 0 47	57 8	30 59 7
6	11 1 27	57 15	31 4 2
5	11 1 58	57 25	31 10 8
4	11 2 22	57 33	31 15 9
3	11 2 57	57 37	31 18 5
2	11 3 45	57 45	31 23 8
1	11 4 27	57 48	31 25 7
	11 4 55	58 6	31 30 9
	11 5 30	58 8	31 32 2
	11 6 27	58 8	31 32 2

The irregular decrease and increase of the distances between the points of the cusps, is greater than would arise in so excellent a micrometer from the small imperfections inseparable from such observations. These irregularities were principally occasioned by the uneven surface of the moon, particularly that part, which formed the southern cusp or horn.—The northern cusp was well defined, and finely terminated, but the southern one was sometimes obtuse, at others terminated by a parallel thread of light, which disappeared from one end to the other, at the same time; and frequently one or two luminous points of the sun's limb, were observed to be completely detached from the point of the cusp.—The most remarkable of these phenomena was observed between $10^h\ 52'$, and $10^h\ 55'$. To give some idea of this appearance, let the circle A B C D Fig. 2d, Pl. VI. represent the periphery of the sun's disk, and EBFD that of the moon's: the line EAFC a vertical, supposed to pass through the centre of the sun:—then B will represent the point of the southern cusp. At about 10^h 53′ the point of the cusp appeared as in Fig. 3, the thread of light, a b, disappeared from one end to the other, at the same instant, the point of the cusp then appeared as in Fig. 4.—In a very short time the thread of light which connected b with the body of the cusp disappeared, and left b visible for a number of seconds, after it was detached from the other visible part of the sun. The cusp then appeared very obtuse, as represented in Fig. 5 which was observed by those who were using the most indifferent glasses.

Those detached luminous points of the sun's limb, seemed to retain their brilliancy, till the instant of their disappearance, which it would appear should not have been the case, if the moon was surrounded with an atmosphere:—those points particularly, which were formed by depressions in the moon's limb, would have had their splendor somewhat diminished, by the density of the atmosphere, if one existed:—but nothing of the kind was observed.

The sun's diameter was found by a great number of observations, made both on the day of the eclipse, and the day preceding, to be $58\frac{8}{50}$ divisions of the micrometer:—the denominator of the fractional part of a division being constantly 50 the numerators only are entered in the observations.—When the first measures were taken, a line joining the points of the cusps passed nearly through the centre of the sun:—in that situation it will easily be seen that the distances must remain for a few minutes so nearly the same, that but little advantage can be drawn from the observations; on this account I have only made out the results of twelve observations on each side of the measure, taken at 10^h 55′ 27″, which turns out accidentally to be, not only the middle observation, but the shortest observed distance between the points of the cusps:—the first and three last observations, are therefore omitted in the calculations. These observations may be so varied, as to furnish a great number of results, because any two, however taken, on different sides of the apparent conjunction, may be considered almost equivalent to the observation of an eclipse, and the calculation made upon the same principles, only using the distance of the centres, instead of the sum of the semidiameters.—Those which I used, are marked numerically in the margin, on each side of the nearest observed distance between the points of the cusps:—the corresponding numbers answer to the two observations for which a particular calculation was made.—This arrangement furnished me with twelve separate determinations, from the mean of which it appeared, that upon the supposition of the longitude of Lancaster being $5^h\ 5'\ 6''$ and the latitnde $40°\ 2'\ 36''$ the moon's longitude as deduced from Mason's tables will be $1'\ 1''$ too great, and the latitude $11''$ too small:—But by the eclipse, independently of the measures taken by the micrometer, the moon's longitude by the tables will be $52''$ too great, and her latitude $3''$ too small.—If, however, the tables should be found correct, at the royal observatory of Greenwich, by the observation of the same eclipse, or other methods, the longitude of Lancaster must be reduced about $1'\ 33''$ in time, by the beginning and end of the eclipse, and still more by the measures taken with the micrometer.—It is probable that the error is partly in the tables, and partly in the assumed longitude of Lancaster.

By the beginning and end of the eclipse, the true conjunction under the meridian of Lancaster, was at $11^h\ 15'\ 31''$ A. M. apparent time; and by the measures taken with the micrometer at $11^h\ 15'\ 47''$.

In making the calculations I have allowed $5''$ for inflexion, and irradiation, and diminished the altitude of the pole $14'\ 38''$, and the moons horizontal parallax $6''$ on account of the spheroidal figure of the earth.

I am, dear sir, with great esteem,

your friend and humble servant,

ANDREW ELLICOTT.

Robert Patterson Esq.
V. P. of the A. P. S.

From the same to the same.

Read September 19th, 1806.

Lancaster, August 16th, 1806.

Three days ago, I received a letter from my friend, Mr. Dunbar, at Natchez, containing his observations on the solar eclipse of the 16th of June last: they are as below.

"Beginning } at { 8h 5′ 19″ } A. M. Apparent time."
"End } at { 10 38 48 }

In deducing the latitude and longitude of the moon, from the above observations, I have diminished the sum of the semi-diameters of the sun, and moon 5″, for the effect of irradiation and inflexion:—the altitude of the pole 13′, and the horizontal parallax of the moon 4″ on account of the spheroidal figure of the earth.

	h	′	″	
By { the beginning / the end } the conjunction was at { 10h 15′ 21″ / 10 15 20 } Mean.	10	15	20	5
The conjunction at Philadelphia by your observations.	11	20	17	5
Difference of meridians.	1	4	57	0
Whilst residing at Natchez, some years ago, I settled the difference of meridians between that place and Philadelphia, from my observations at 16° 15′ 46″* =	1	5	3	
difference only	0	0	6	
Let us now take the longitude of Philadelphia, (as long settled) for a given point	5	0	37	
Add the difference of meridians between Philadelphia and Natchez.	1	4	57	
Longitude of Natchez.	6	5	34	
Conjunction at Philadelphia by your observations.	11	20	17	
Conjunction at Lancaster.	11	15	31	
Difference of meridians.	0	4	46	
Add longitude of Philadelphia.	5	0	37	
Longitude of Lancaster.	5	5	23	
This longitude exceeds that drawn from the measure of the turnpike road, and some of my former observations.	0	0	17	

The difference of the meridians as above stated, agree so nearly with former determinations, that there can remain but little doubt, that the difference in longitude, between the places above mentioned, and Greenwich, as drawn from the late eclipse of the sun, and as heretofore settled, arises principally

* See Philosophical Transactions, Vol. IV. page 451.

from the imperfections of the lunar tables, which appear to give the moon's longitude at the time of the eclipse at least 1 too much: the error in latitude at the same time is almost insensible.

No. XLII.

Observations of the eclipse of the sun, June 16th, 1806: made at the Forest, near Natchez.—Latitude 31° 27′ 48″ N. and supposed Longitude about 6^h 5′ 25″ to 40″, W. of Greenwich, by William Dunbar Esq.

Read August 15th, 1806.

IN these observations, an excellent clock with a gridiron pendulum was used, made by J. Bullock of London; a portable chronometer served occasionally as a companion to the clock, which last was frequently regulated and corrected, by equal altitudes of the sun, taken by a circle of reflection.

☽ April 28th, 1806, astronomical time. With a six-feet Gregorian reflecting telescope, power 100, observed an occultation of e leonis by the moon, as follows:

☽ e ♌ Immersion at 8^h 49′ $10\frac{1}{2}$″, per clock. The emersion was not seen; the star was at some distance from the moon's limb, before it was noticed, which was ascribed to the extreme brightness of the moon, then nearly on the meridian.

The following new and short formula was used, for finding the equation of equal altitudes, viz. To the logarithmic cosine of the latitude, add the sine of the half-interval, in degrees, and the arith. comp. of the cosine (or secant) of the altitude; the sum, rejecting tens from the index, is the sine of an angle: take out the corresponding cotangent, to which add the arith. comp. of the cosine (or secant) of the sun's declination, and the logarithm of the declination, gained or lost during the half-interval, reduced to seconds of time; the sum, rejecting tens from the index, is the logarithm of the correction or equation of equal altitudes, in seconds of